

REMARKS

Claim 19 is objected to for an informality stated in the Office Action. The claims are amended above in a manner consistent with suggestions in the Office Action. Reconsideration is requested.

Claims 1-10, 16, 18-21, 23-28, 34 and 36-38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tsu, *et al.* (U.S. Patent Number 6,461,955) in view of Aoi (U.S. Patent Number 6,387,824). Claims 17 and 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tsu, *et al.* in view of Aoi, and further in view of Robinson, *et al.* (U.S. Patent Number 4,201,579). Claims 11-12, 14-15, 29-30 and 32-33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tsu, *et al.* in view of Aoi, and further in view of Lui (U.S. Patent Number 6,391,761). Claims 13, 31 and 39-52 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tsu, *et al.* or Aoi in view of Lui and further in view of Lee, *et al.* (U.S. Patent Number 6,171,951). In view of the amendments to the claims and the following remarks, the rejections are respectfully traversed, and reconsideration of the rejections is requested.

In the present invention of claims 1-20, a method of fabricating dual damascene interconnections includes forming a hybrid dielectric layer on a substrate, and forming a via in the dielectric layer. The via is filled with a carbon-free inorganic filler. The method further includes processing the surface of the carbon-free inorganic filler using plasma.

Claim 1 is amended to clarify certain features of the invention. Specifically, the claims are amended to clarify that the method of fabricating dual damascene interconnections includes processing the surface of the carbon-free inorganic filler using plasma. It is believed that these amendments to the claims clarify the distinctions between the claimed invention and the cited references.

In the present invention of claims 21-38, a method of fabricating dual damascene interconnections includes forming an organo silicate glass layer on a substrate, and forming a via in the organo silicate glass layer. The via is filled with an HSQ-based filler. The method further includes processing the surface of the HSQ-based filler using plasma.

Claim 21 is amended to clarify certain features of the invention. Specifically, the claims

are amended to clarify that the method of fabricating dual damascene interconnections includes processing the surface of the HSQ-based filler using plasma. It is believed that these amendments to the claims clarify the distinctions between the claimed invention and the cited references.

In the present invention of claims 39-52, a method of fabricating dual damascene interconnections includes forming a lower interconnection on a substrate and forming an etch stop on the lower interconnection. The method further includes forming an organo silicate glass layer on the etch stop layer and forming a via through the organo silicate glass layer to expose the etch stop. The via is filled with an HSQ-based filler. The surface of the HSQ-based layer is processed using plasma, and an anti-reflection layer is formed on the plasma-processed surface of the HSQ-based filler.

The combined teachings of Tsu, *et al.*, Aoi and Lui are cited in the Office Action at page 5, paragraph 6, as failing to disclose expressly plasma treating the filler and the details about the plasma.

Tsu, *et al.* discloses depositing a via protect layer 114 to fill a via. With reference to FIG. 2C of Tsu, *et al.*, after depositing the via protect layer 114, the via protect layer 114 is selectively etched back. A trench pattern 120 is then formed on a hardmask layer 110 and an IMD layer 108 and the via protect layer 114 filling the via are etched.

Tsu, *et al.* fail to teach or suggest that the method of fabricating dual damascene interconnections includes processing a surface of a carbon-free inorganic filler using plasma, as claimed in claims 1-20. Instead, in Tsu, *et al.* the surface of the via protect layer 114 is not processed using plasma.

Tsu, *et al.* fail to teach or suggest that the method of fabricating dual damascene interconnections includes processing a surface of an HSQ-based filler using plasma, as claimed in claims 21-38 and 39-52. Instead, in Tsu, *et al.* the surface of the via protect layer 114 is not processed using plasma.

Aoi discloses a resist pattern 12 formed having an opening over a region of an organic-inorganic hybrid film 11 to be used as a mask to form a wire groove or contact hole in the

Application Number 10/625,007  
Amendment dated September 1, 2005  
Reply to Office Action of June 2, 2005

organic-inorganic hybrid film 11.

Aoi fails to teach or suggest that the method of fabricating dual damascene interconnections includes processing a surface of a carbon-free inorganic filler using plasma, as claimed in claims 1-20.

Aoi fails to teach or suggest that the method of fabricating dual damascene interconnections includes processing a surface of an HSQ-based filler using plasma, as claimed in claims 21-38 and 39-52.

Hence, neither of Tsu, *et al.* and Aoi teaches or suggests certain elements of the present invention set forth in amended claims 1-38. Specifically, neither of the references teaches or suggests a method of fabricating dual damascene interconnections that includes processing a surface of a carbon-free inorganic filler using plasma, as claimed in claims 1-20. In addition, neither of the references teaches or suggests that a method of fabricating dual damascene interconnections includes processing a surface of an HSQ-based filler using plasma, as claimed in claims 21-38. Accordingly, there is no combination of the references which would provide such teaching or suggestion. Neither of the references, taken alone or in combination, teaches or suggests the invention set forth in the amended claims 1-38. Therefore, it is believed that the amended claims 1-38 are allowable over the cited references, and reconsideration of the rejections of claims 1-10, 16, 18-21, 23-28, 34 and 36-38 under 35 U.S.C. § 103(a) based on Tsu, *et al.* and Aoi is respectfully requested.

Robinson, *et al.* is cited in the Office Action as disclosing the use of H<sub>2</sub>-based plasma to remove photoresist. Robinson, *et al.* fail to teach or suggest a method of fabricating dual damascene interconnections that includes processing a surface of a carbon-free inorganic filler using plasma, as claimed in claims 1-20. In addition, Robinson, *et al.* fail to teach or suggest a method of fabricating dual damascene interconnections that includes processing a surface of an HSQ-based filler using plasma, as claimed in claims 21-38 and 39-52.

Hence, none of Tsu, *et al.*, Aoi, as discussed above, and Robinson, *et al.* teaches or suggests certain elements of the present invention set forth in amended claims 1-38. Specifically, none of the references teaches or suggests a method of fabricating dual damascene

interconnections that includes processing a surface of a carbon-free inorganic filler using plasma, as claimed in claims 1-20. In addition, none of the references teaches or suggests a method of fabricating dual damascene interconnections that includes processing a surface of an HSQ-based filler using plasma, as claimed in claims 21-38. Accordingly, there is no combination of the references which would provide such teaching or suggestion. None of the references, taken alone or in combination, teaches or suggests the invention set forth in the amended claims 1-38. Therefore, it is believed that the amended claims 1-38 are allowable over the cited references, and reconsideration of the rejections of claims 17 and 35 under 35 U.S.C. § 103(a) based on Tsu, *et al.*, Aoi and Robinson, *et al.* is respectfully requested.

Lui is cited in the Office Action as disclosing the use of an organic anti-reflective layer 85. Lui fails to teach or suggest a method of fabricating dual damascene interconnections that includes processing a surface of a carbon-free inorganic filler using plasma, as claimed in claims 1-20. In addition, Lui fails to teach or suggest a method of fabricating dual damascene interconnections that includes processing a surface of an HSQ-based filler using plasma, as claimed in claims 21-38 and 39-52.

Hence, none of Tsu, *et al.*, Aoi, as discussed above, and Lui teaches or suggests certain elements of the present invention set forth in amended claims 1-38. Specifically, none of the references teaches or suggests a method of fabricating dual damascene interconnections that includes processing a surface of a carbon-free inorganic filler using plasma, as claimed in claims 1-20. In addition, none of the references teaches or suggests a method of fabricating dual damascene interconnections that includes processing a surface of an HSQ-based filler using plasma, as claimed in claims 21-38. Accordingly, there is no combination of the references which would provide such teaching or suggestion. None of the references, taken alone or in combination, teaches or suggests the invention set forth in the amended claims 1-38. Therefore, it is believed that the amended claims 1-38 are allowable over the cited references, and reconsideration of the rejections of claims 11-12, 14-15, 29-30 and 32-33 under 35 U.S.C. § 103(a) based on Tsu, *et al.*, Aoi and Lui is respectfully requested.

Lee, *et al.* discloses an implanting step is preformed on a dielectric layer 310 by plasma

treatment.

Lee, *et al.* fail to teach or suggest a method of fabricating dual damascene interconnections that includes processing a surface of a carbon-free inorganic filler using plasma, as claimed in claims 1-20. Instead in Lee, *et al.* the dielectric layer 310 is plasma treated, rather than a carbon-free inorganic filler as claimed in claims 1-20.

Lee, *et al.* further fail to teach or suggest a method of fabricating dual damascene interconnections that includes processing a surface of an HSQ-based filler using plasma, as claimed in claims 21-38 and 39-52. Instead in Lee, *et al.* the dielectric layer 310 is plasma treated, rather than an HSQ-based filler as claimed in claims 21-52.

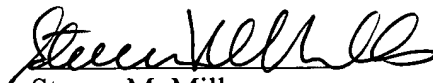
Hence, none of Tsu, *et al.*, Aoi, Lui, as discussed above, and Lee, *et al.* teaches or suggests certain elements of the present invention set forth in amended claims 1-38 and claims 39-52. Specifically, none of the references teaches or suggests a method of fabricating dual damascene interconnections that includes processing a surface of a carbon-free inorganic filler using plasma, as claimed in claims 1-20. In addition, none of the references teaches or suggests a method of fabricating dual damascene interconnections that includes processing a surface of an HSQ-based filler using plasma, as claimed in claims 21-38 and 39-52. Accordingly, there is no combination of the references which would provide such teaching or suggestion. None of the references, taken alone or in combination, teaches or suggests the invention set forth in the amended claims 1-38 and claims 39-52. Therefore, it is believed that the amended claims 1-38 and claims 39-52 are allowable over the cited references, and reconsideration of the rejections of claims 13, 31 and 39-52 under 35 U.S.C. § 103(a) based on Tsu, *et al.*, Aoi, Lui and Lee, *et al.* is respectfully requested.

Application Number 10/625,007  
Amendment dated September 1, 2005  
Reply to Office Action of June 2, 2005

In view of the amendments to the claims and the foregoing remarks, it is believed that all claims pending in the application are in condition for allowance, and such allowance is respectfully solicited. If a telephone conference will expedite prosecution of the application, the Examiner is invited to telephone the undersigned.

Respectfully submitted,

Date: 9/1/05  
Mills & Onello, LLP  
Eleven Beacon Street, Suite 605  
Boston, MA 02108  
Telephone: (617) 994-4900  
Facsimile: (617) 742-7774  
J:\SAM\0313CIP\amenda\amendment2.wpd

  
Steven M. Mills  
Registration Number 36,610  
Attorney for Applicants